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Farms, the Internet, & E-Commerce: Adoption & Implications

Internet use by U.S. farmers has grown rapidly, as advances in computer and other communication and information technology (CIT) make the Internet more accessible. USDA recently reported that the use of computers on farms has grown from 38 to 55 percent since 1997, while Internet use has grown from 13 to 43 percent. In 2000 (the most recent year available), 24 percent of farms used the Internet as a management tool in their farming operation according to USDA's annual Agricultural Resource Management Study (ARMS) survey.

CIT is a tool that makes information more accessible and therefore improves the quality of decisions by managers. Some farmers are long-time users of many variants of CIT, including cell phones and other hand-held electronic devices, computers, and most recently, global positioning system technology.

As a technology, the Internet has the additional benefit of minimizing some constraints on a farmer's ability to receive and manage information, regardless of where the farm is located or when the information is used. Moreover, because the costs of Internet-provided communication and information gathering services can be substantially lower, the commercial opportunities of the Internet may afford farmers new ways to build business partnerships, including opportunities to purchase inputs and sell products.

Which Internet Services For Agriculture?

At the time when publicity about the potential of business-to-business electronic commerce was greatest, many firms sprang up to compete for farm-sector transactions. To assess the success of these efforts, the ARMS survey asked farmers to report all types of financial, communication, and information-gathering activities as well as their online buying and selling. In 2000, farmers were particularly interested in information-gathering activities, online financial activities, online purchases, and crop and livestock sales.

During 2000, producers reported $665 million in online buying and selling, equal to 0.33 percent of all purchases and sales by U.S. farms. Online purchases totaled $378 million, covering machinery and equipment, farm supplies, crop inputs, livestock inputs, and office and computer equipment. Purchases of crop and livestock input together were 35 percent of total online purchases, and each was smaller than machinery and equipment purchases and general farm supply purchases. Online sales by farmers totaled $287 million—$191 million in livestock sales and $96 million in crop sales.

Farms using the Internet reported implementing the technology for a number of different reasons:

- price tracking, 82 percent of Internet users
- agricultural information services, 56 percent
- accessing information from USDA, 33 percent
- communication with:
    - other farmers, 31 percent of Internet users
    - crop advisors, 28 percent of Internet users
- online record keeping and data transmission to clients and service providers, 31 percent.

Information Gathering Was the Dominant Activity Among U.S. Farmers Reporting Internet Use in 2000

Activity	Number of farms	Share of all farms[1]	Share of farm Internet users[2]
	1,000	*Percent*	*Percent*
Purchases	60	3	11
Sales	19	1	4
Information	517	24	98
Financial	66	3	13
Any use	528	24	100

1. Total number of farms: 2,163,865 2. Total number of farms using Internet: 528,000.
Data are from a sample of farms.
Source: 2000 Agricultural Resource Management Study, USDA.

Economic Research Service, USDA

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ERS Farm Typology Groups

Small Family Farms (sales less than $250,000)

Limited-resource. Any small farm with gross sales less than $100,000, total farm assets less than $150,000, and total operator household income less than $20,000. Limited-resource farmers may report farming, a nonfarm occupation, or retirement as their major occupation.

Retirement. Small farms whose operators report they are retired (excludes limited-resource farms operated by retired farmers).

Residential/lifestyle. Small farms whose operators report a major occupation other than farming (excludes limited-resource farms with operators reporting a nonfarm major occupation).

Farming-occupation, low-sales. Small farms with sales less than $100,000 whose operators report farming as their major occupation (excludes limited-resource farms whose operators report farming as their major occupation).

Farming-occupation, high-sales. Small farms with sales between $100,000 and $249,999 whose operators report farming as their major occupation.

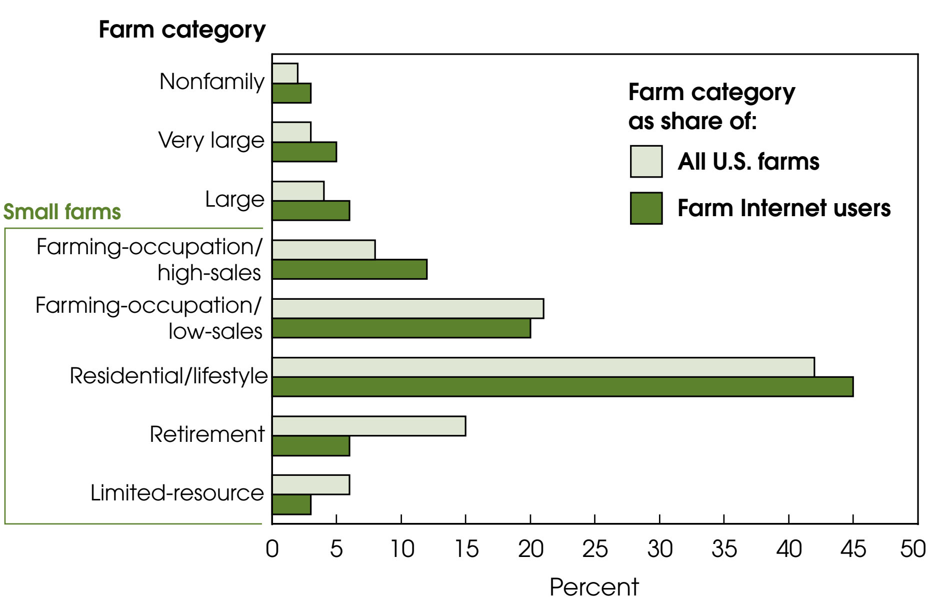
Other Farms

Large family. Farms with sales between $250,000 and $499,999.

Very large family. Farms with sales of $500,000 or more.

Nonfamily. Farms organized as nonfamily corporations or cooperatives, as well as farms operated by hired managers.

Internet Use Is Above Average for Most Farm Typology Categories



If a category's share in the "farm Internet users" population exceeds the share in the "all U.S. farms" population, then Internet adoption in that category is higher than average.

Economic Research Service, USDA

Demand for financial services in agriculture is usually quite strong, as 40 percent of all farm households maintain some amount of business debt, and many more use financial institutions extensively. Three percent of all farms used the Internet to help manage some facet of their business finances.

- online banking, 10 percent of Internet users
- paying bills, 7 percent
- obtaining loans, 2 percent.

Although only 1 percent of farm operators report that security in general keeps them from using the Internet in their business, security concerns likely contribute to low use of the Internet for financial transactions.

Which Farms Are Likely To Use the Internet?

Technological change has long been a staple of the agricultural economy. In general, adopters have characteristics that distinguish them from nonadopters. In the past, farms with younger, more educated managers and with larger sized operations were quickest to adopt any new technologies. Adoption of the Internet is apparently following the same pattern, as more educated operators and larger sized farms had higher rates of use than did others. Adoption was more uniform for all farmers under 55, declining for upper age groups. Groups reporting higher adoption are those that share both the abilities and the need to find strategies to improve management decisionmaking, including increasingly complicated purchasing, production, and marketing decisions.

Farm typology. To examine Internet use by various types of farms, the ARMS data were analyzed using the farm typology constructed by USDA's Economic Research Service (ERS). The ERS farm typology classifies farm households by principal occupation of the farm manager, amount of sales generated by the farm, and economic resources available to the household.

Comparing the population of Internet users and all farms, differences in population share for each category of the farm typology were examined. If the share in the "all farms" population exceeds the share in the "Internet users" population, then farms making up the category have lower-than-average Internet adoption. If the share in the "Internet users" population exceeds the share in the "all farm" population, farms in that category have higher-than-average adoption.

In 2000, farms with more than $100,000 in sales had higher-than-average Internet adoption. The farming-occupation, low-sales small farm category (those farms with less than $100,000 in sales for 2000), had lower-than-average Internet adoption, while residential/lifestyle farms had slightly higher-than-average Internet adoption. Retirement and limited-resource farm households had slightly lower-than-average Internet adoption.

Overall, Internet adoption by the various types of farms is not far from average, indicating that Internet use among farms is not disproportionately weighted toward any particular type of farm. Internet adopters are distributed roughly proportionally to their representation within the agricultural sector. This may also reflect that while adopters are younger, have more formal education, and generally higher sales, farmers with some of these characteristics can come from a rather broad cross-section of the agricultural sector.

Commodity type. Technologies introduced in the past, such as new planting technology, precision agriculture, and selective breeding to improve livestock herds, were designed for an obvious and singular purpose, with "spinoff" technologies the primary source of benefits for other farms. Most often, the new technology was tied to an individual enterprise, so that farms that did not engage in that enterprise were only affected indirectly, if at all.

This does not appear to be the case with Internet use. Internet use by farm businesses seems to be equally attractive to those specializing in crop or livestock production. Internet users appear to follow the same 59-41 percent split between livestock and crop specialization that is representative of the farming sector as a whole.

Farm Businesses: Digital Leaders or Followers?

How does Internet use by farmers compare with other parts of the economy? In general, farm household use is comparable to that of nonfarm households. Use of the Internet within the farm business is similar to use by small manufacturing firms, but is less than use by larger manufacturing firms. The share of total electronic business transactions in agriculture is less than the overall rate of electronic transactions at both the retail and nonagricultural firm levels.

	Rate of Internet use	E-commerce: Purchases and sales	E-commerce: Share of sector's purchases and sales
	Percent	*$ million*	*Percent*
Farm businesses[1]	43	665	0.33
General population[2]	41	27,000	0.89
All manufacturers[3]	84	592,000	16
Small manufacturers[3]	47	65	4

1. 2001 June Agricultural Survey, 2000 Agricultural Resource Management Study, USDA. 2. 2000 Current Population Survey Computer Use Supplement and Monthly Retail Trade Survey, U.S. Census Bureau.
3. 1999 Annual Survey of Manufacturers, U.S. Census Bureau. Small manufacturers have less than five employees.

Economic Research Service, USDA

The Rural-Urban Digital Divide

In general, adoption of information technologies follows a pattern similar to adoption of other production technologies. But, adoption may be more an issue of "willingness to adopt" than of whether the technology is somehow inappropriate for particular kinds of farms. Concerns have been raised that lack of adoption has more to do with inadequate infrastructure and other barriers to access than with farmer interest in using CIT.

The "digital divide" relates to the relative economic disadvantage of lack of access to the Internet. It is the term normally used to discuss a variety of concerns that spring from a gap between Internet users and nonusers that threatens the current or future economic power of a group. Rural households as a group have traditionally had low rates of Internet use. Among the reasons cited are their older, more isolated populations, generally low rates of employment in high-tech sectors, and lack of Internet service providers in some rural areas.

The most recent empirical assessment of the digital divide was contained in the 2000 Current Population Survey, indicating that rural households had demonstrated rapid gains in Internet use, thereby reducing the rural-urban digital divide. ARMS data indicate that 43 percent of farms reported that they did not use the Internet because they did not own a computer while only 4 percent report inadequate Internet service as the reason they did not use the Internet in their business.

To address changes in Internet use along a rural-urban continuum, ARMS data were analyzed using an index developed at ERS that classifies all U.S. counties by their degree of urbanization and proximity to a metropolitan area. A digital divide, where it exists, can be detected by spotting large differences between the group's share among all farms and the group's share among Internet users. The results show that as the degree of urbanization and proximity to a metropolitan area declines, Internet use also tends to decrease slightly. This supports the idea that a farm's likelihood of using the Internet decreases with distance from an urban area.

About 85 percent of all farms are located in counties that contain a metropolitan area or have an urban population of at least 2,500 people. The digital divide lessens at the rural extreme, where the remaining 15 percent of farms are located. Farms located in totally rural counties have the same representation in the "all farm" population as in the "Internet user" population, indicating that their Internet adoption is the same as the national average. While Internet use for totally rural counties may be more costly, because toll calls are sometimes required, the benefits may be higher. For example, for a relatively remote farm, time and location constraints are potentially the greatest, while a less remote farm may have other options nearby that lessen the advantage of using the Internet.

Future of Farm CIT

In 2000, business use of the Internet was reported on almost a quarter of all farms. Use was similar across many different types of farms, which indicates that CIT potentially has general appeal, and is not necessarily the domain of only a portion of the farm population. Because most types of farms seem to be adopting the Internet at similar rates, CIT does not appear to be associated more with any particular type of farm. Continued cost reductions for CIT use will likely increase the number of farms using the Internet, while farms that used the Internet in 2000 will likely further integrate CIT into their business. Nearly all farms using the Internet in 2000 to purchase inputs indicated that they are likely to maintain or increase purchases in the future.

The analysis of adoption of Internet technology for management decision-making demonstrates that diffusion has been rapid and relatively widespread across the agricultural sector. There was no attempt to quantify the net economic benefits enjoyed by adopters of CIT relative to nonadopters, although these are the subject of continued study. Most farms appear to be using the Internet for only a portion of their overall farm business, suggesting that they are still discovering for themselves how to best take advantage of the technology.

We draw three implications of Internet adoption for farmers and those who do business with them. First, nonadopting farms may want to periodically reexamine the technology's applicability to their operations. Although some analysts expected the Internet to fundamentally change the structure of agriculture, it appears that those farmers who are using the Internet are currently simply substituting one technology for another. While much of what is done on the Internet can be done by telephone, fax, mail, or in person, there is little evidence that any one of these technologies is superior to another.

Second, because experimentation may lead to different uses of the technology that go beyond substitution for older technologies, tracking further developments on the impacts of the Internet on farm performance is warranted.

Third, ignoring the capabilities of the Internet for information dissemination and maintaining contact with farmer clients could be a costly mistake for those who serve farmers, as adopters in general appear willing to use the Internet in a variety of ways. AO

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